

Appl. No. 10/635,489
Amendment dated: December 8, 2005
Reply to OA of: September 12, 2005

REMARKS

Applicants acknowledge with appreciation the courtesy of the interview extended the Applicants representative by Examiner Vu, the Examiner in charge of this application, on November 2, 2005. During the interview, the present invention, the outstanding Official Action and the prior art references were discussed. Specifically, with respect to Voutsas and Gosain references, Applicants representative argued that neither reference disclosed a first step of forming an a-Si layer and a subsequent step of doping the a-Si layer. The Examiner responded that the claims as currently presented do not require any specific sequential order of steps. The Examiner noted that amending the claims to more precisely recite sequential steps would overcome these rejections. With respect to the Yamazaki reference, Applicants representative argued that the reference fails to disclose an a-Si buffer layer and an a-Si layer disposed thereon. The Examiner responded that the claims as presented could be broadly interpreted to recite a single a-Si layer that can serve as both a buffer layer and an a-Si layer. The Examiner noted that amending the claims to more precisely claim two distinct layers would overcome the rejections. However, the Examiner noted that either set of amendments would raise new issues and therefore need to be presented in conjunction with a Request for Continued Examination in order for the amendments to be entered and considered.

Accordingly, Applicants submit herewith a Request for Continued Examination in conjunction with an Amendment to more precisely define the present invention, taking into account the outstanding Official Action and the outcome of the Interview.

Claim 1 has been amended to recite that the steps of providing an amorphous silicon substrate comprise forming an amorphous silicon buffer layer on a substrate and forming an amorphous silicon layer on the amorphous silicon buffer layer. Claim 1 has also been amended to recite that the heating of the amorphous silicon substrate is by laser annealing.

Appl. No. 10/635,489
Amendment dated: December 8, 2005
Reply to OA of: September 12, 2005

New claims 12-19 have also been added. Independent claim 12 recites a method for transforming an amorphous silicon layer into a polysilicon layer comprising forming an amorphous silicon layer on a substrate, doping the amorphous silicon layer with an inert gas atom, and heating the surface of the amorphous silicon layer by laser annealing.

Support for all of these amendments may be found throughout the specification as originally filed. In light of these amendments, Applicants respectfully submit that all claims present in the application are in full compliance with all of the requirements of 35 U.S.C. §112 and are now in condition for allowance.

The rejection of claims 1-6, 8, 9 and 11 under 35 U.S.C. §102(e) as being anticipated by Voutsas has been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

Applicants respectfully assert that the method for transforming an amorphous silicon layer into a polysilicon layer as claimed in the present invention is different from the method disclosed in Voutsas.

In the method disclosed in Voutsas, as described at column 3, lines 46-48, Argon gas accompanied with an additional small amount of hydrogen gas are used together as a "sputtering gas". This mixture of "sputtering gas" is supplied into the deposition

Appl. No. 10/635,489

Amendment dated: December 8, 2005

Reply to OA of: September 12, 2005

chamber during the deposition of amorphous silicon film (see column 4, lines 12-23), that is, before an amorphous silicon film has been completely formed.

To the contrary, the inert gas of the present application is fed into the reaction chamber having the amorphous silicon layer already provided therein. The doping process is performed after the formation of the amorphous silicon layer(s) is completed. In other words, before performing the doping process claimed in the present application, the process of depositing the amorphous silicon layers on the substrate, i.e. forming the amorphous silicon substrate, must have already been completed. During the deposition of the amorphous silicon layer, such as by physical sputtering, some kinds of gases must be used as "sputtering gas". However, these gases are different from the doping gases used to dope the amorphous silicon layer after the amorphous silicon layer is formed. Therefore, the "sputtering gases" disclosed in Voutsas are different from the doping gas claimed in the present application.

Because the inert sputtering gas disclosed in Voutsas is used for the formation of an amorphous silicon layer and not for doping an already formed amorphous silicon layer as claimed in the present application, Applicants respectfully request that rejection of claim 1 and all claims depending therefrom be withdrawn.

The rejection of claims 1, 2, 5, 8, 9 and 11 have been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants respectfully assert that the method for transforming an amorphous silicon layer into a polysilicon layer as claimed in the present application is different from that of the method disclosed in Gosain.

The formation of a polycrystalline silicon layer as disclosed in Gosain at e.g., column 3, lines 1-67, does not include a step comprising doping an amorphous silicon layer by the use of an inert gas as claimed in the present invention. As disclosed at column 3, lines 27-43 of Gosain, after the formation of the amorphous silicon layer, the amorphous silicon layer is then heated by, for example, a pulsed laser beam. However,

Appl. No. 10/635,489
Amendment dated: December 8, 2005
Reply to OA of: September 12, 2005

there is no doping process in between formation of the amorphous silicon layer and the heating step.

The only doping process disclosed in Goasin is an “impurity doping” process, as describe at column 4, lines 21-31. This impurity doping process is for the purpose of doping phosphorus or boron into the polycrystalline silicon layer, not an amorphous silicon layer as claimed in the present invention. Because this doping step is with respect to the polycrystalline silicon layer, it follows that the only doping process disclosed in Gosain occurs after the heating process. To the contrary, the doping process of the present patent application is before the heating process converts the amorphous silicon layer into a polycrystalline silicon layer.

Further, the only process using any kind of inert gas disclosed in Gosain is again the “impurity doping” process as described at column 6, lines 21-35. The inert gas Helium and the PH₃ gas together form the glow-discharge plasma to adsorb n-type impurity, such as phosphorous, near the surface of the polycrystalline silicon layer. As described above, this process occurs after the heating process. Applicants respectfully submit that there is clearly no doping process before the formation of the polycrystalline silicon layer in Gosain and therefore Gosain fails to disclose every element of the presently amended claims.

Because claim 1 of the present application is not anticipated by Gosain, Applicants respectfully request that this rejection be withdrawn.

The rejection of claims 1-6 and 8-10 under 35 U.S.C. §102(e) has been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants respectfully assert that the method for transforming an amorphous silicon layer into a polysilicon layer as claimed in the present application is different from that of the method disclosed in Yamazaki.

The Official Action urges, in part, that the amorphous silicon buffer layer and the amorphous silicon layer claimed in the present application are merely broad limitations

Appl. No. 10/635,489

Amendment dated: December 8, 2005

Reply to OA of: September 12, 2005

that encompass amorphous silicon layers. Applicants specifically traverse this statement for the following reasons.

As is well known in the art, the two-layered structure of the amorphous silicon film is widely used in manufacturing TFT transistors, especially ones used in LCDs. The two-layered structure of an amorphous silicon film has several advantages including the following.

First, during a heating process, such as the ELA process claimed in the present application, the amorphous silicon buffer layer can prevent the heat from transmitting to the substrate. In other words, by forming the amorphous silicon buffer layer between the substrate and the amorphous silicon layer which will be later transformed into polysilicon layer, the heat energy of the heat treatment is confined to the amorphous silicon layer and converts the amorphous silicon therein into polysilicon. As a result, the amount of the heat energy required and the process time of the heat treatment is reduced.

Further, once the heating process (ELA process) is completed, (i.e., after the amorphous silicon layer is transformed into the polysilicon layer, the amorphous silicon buffer layer can prevent the impurities of the substrate from drifting into the polysilicon layer. Thus, by forming an amorphous silicon buffer layer, the possibility of the polysilicon layer being contaminated by the impurities is minimized.

Therefore, Applicants respectfully assert that the two-layered structure of the amorphous silicon film of the present application cannot be considered merely a broad limitation that encompasses amorphous silicon layers as asserted in the Official Action because of the important function the two-layered structure has in the method claimed in the present application.

Further, in light of the amendments to the claims, the presently amended claims clearly recite a two-step process whereby an amorphous silicon buffer layer is disposed on the substrate, followed by the deposition of the amorphous silicon layer. Because Yamazaki clearly fails to disclose this feature of the presently amended claims, Applicants respectfully submit that the rejection should be withdrawn.

Appl. No. 10/635,489
Amendment dated: December 8, 2005
Reply to OA of: September 12, 2005

In view of the foregoing remarks, reconsideration and allowance of the application are now believed to be in order, and such action is hereby solicited. If any points remain in issue that the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,

BACON & THOMAS, PLLC

By: 
Scott A. Brairton
Registration No. 55,020

625 Slaters Lane, 4th Fl.
Alexandria, Virginia 22314
Phone: (703) 683-0500
Facsimile: (703) 683-1080

REF:SAB:cmd
A02.wpd

December 8, 2005